VERIFICATION OF TRANSLATION

I, Tae-Ho Ha of 9th Fl. Seoyoung Bldg., 158-12, Samsung-dong, Kangnam-gu, Seoul, 135-090, Korea, declare that I have a thorough knowledge of the Korean and English languages, and the writings contained in the following pages are correct English translation of the specification and claims of Korean Patent Application No. 2000-0064740.

This 3rd day of February, 2005

By:

[Tae-Ho Ha]

KOREAN INTELLECTUAL

PROPERTY OFFICE

This is to certify that the following application annexed hereto

is a true copy from the records of the Korean Intellectual Property Office

Application Number **: PATENT-2000-0064740**

Date of Application **: November 1, 2000**

Applicant(s) **: LG. Philips LCD Co., Ltd.**

COMMISSIONER

[BIBLIOGRAPHICAL DOCUMENTS]

[TITLE OF DOCUMENT] PATENT APPLICATION

[CLASSIFICATION] PATENT

[RECIPIENT] COMMISSIONER

[REFERENCE NUMBER] 0002

[SUBMISSION DATE] 11. 1. 2000

[TITLE OF INVENTION IN KOREAN] 반사투과형 액정표시장치용 어레이기판과 그 제조방법

[TITLE OF INVENTION IN ENGLISH] method for fabricting a Transflective liquid crystal display device and the same

[APPLICANT]

[NAME IN KOREAN] 엘지. 필립스 엘시디 ㈜

[NAME IN ENGLISH] LG. Philips LCD Co., Ltd.

[APPLICANT CORD] 1-1998-101865-5

[ATTORNEY]

[NAME] Jung, Won-Ki

[ATTORNEY CORD] 9-1998-000534-2

[ALL-INCLUSIVE AUTHORIZATION REGISTRATION NUMBER] 1999-001832-7

[INVENTOR]

[NAME IN KOREAN] 권오남

[NAME IN ENGLISH] KWON, OH-NAM

[IDENTIFICATION NO.] 680603-1411215

[ZIP CODE] 437-040

[ADDRESS] 101-401 Miju Apt., 282-2, Sam-dong, Uiwang-shi, Gyeonggi-do

[NATIONALITY] Republic of Korea

[INVENTOR]

[NAME IN KOREAN] 김웅권

[NAME IN ENGLISH] KIM, WOONG-KWON

[IDENTIFICATION NO.] 700217-1480917

[ZIP CODE] 435-040

[ADDRESS] 640-1204 Sejong Apt., 1145, Sanbon-dong, Gunpo-si, Gyeonggi-do

[NATIONALITY] Republic of Korea

[INVENTOR]

[NAME IN KOREAN] 최재범

[NAME IN ENGLISH] CHOI, JAE-BEOM

[IDENTIFICATION NO.] 700326-1162617

[ZIP CODE] 442-070

[ADDRESS] 306-1101 Seongyeong Apt., Ingye-dong, Paldal-gu, Suwon-si, Gyeonggi-do

[INVENTOR]

[NAME IN KOREAN] 이경묵

[NAME IN ENGLISH] LEE, KYOUNG-MUK

[IDENTIFICATION NO.] 740418-1037518

[ZIP CODE] 152-100

[ADDRESS] 1-106 UseokBilla, 152, Oryu-dong, Guro-gu, Seoul

[NATIONALITY] Republic of Korea

[PURPORT] We submit application as above under the article 42 of the Patent Law.

Attorney Jung, Won-Ki (seal)

[FEES]

[BASIC APPLICATION FEE]	20 pages	29,000	Won
[ADDITIONAL APPLICATION FEE]	4 pages	4,000	Won
[PRIORITY FEE]	0 things	0	won
[EXAMINATION REQUEST FEE]	0 clamis	0	Won
[TOTAL]		33,000	Won

[ENCLOSED] 1. Abstract, Specifications (with Drawings) - 1 set

[DOCUMENT OF ABSTRACT]

[ABSTRACT]

The present invention relates to a liquid crystal display (LCD) device, and more particularly, to a transflective LCD device including both a reflective portion and a transmissive portion in a pixel region.

It is the objectives of the present invention to fabricate an array substrate that the reflective electrode has double metal layers for galvanic phenomenon not to occur between the reflective electrode and the transparent electrode in the patterning process of the transflective electrode in the array substrate of the transmissive LCD device and the gate line has double layers for the lower gate line not to be corroded by an etching solution in the forming process of the transflective electrode and to improve production efficiency of the LCD device.

[REPRESENTATIVE FIGURE]

FIG. 5f

[SPECIFICATIONS]

[NAME OF INVENTION]

Method for fabricating a Transflective liquid crystal display device and the same

[BRIEF EXPLANATION OF FIGURES]

FIG. 1 is an exploded perspective view illustrating a portion of a typical transflective LCD device;

FIG. 2 is a cross-sectional view illustrating a typical transflective LCD device;

FIG. 3 is an expanded plan view illustrating some pixels of an array substrate for a conventional transmissive LCD device;

FIGs. 4a to 4d are sequential processing cross-sectional views taken along lines II-II`, III-III` and IV-IV` of FIG. 3; and

FIGs. 5a to 5f are sequential processing cross-sectional views taken along lines II-II`, III-III` and IV-IV` of FIG. 3 according to the present invention;

* Explanation of major parts in the figures *

163 : pixel electrode	166 : first reflective electrode
168 : second reflective electrode	165 : gate pad
166 : data pad	

[DETAILED DESCRIPTION OF INVENTION]

[OBJECT OF INVENTION]

[TECHNICAL FIELD OF THE INVENTION AND PRIOR ART OF THE FIELD]

The present invention relates to a liquid crystal display (LCD) device, and more particularly, to a transflective LCD device using selectively a transmissive mode a reflective mode.

Generally, a transflective LCD device has advantages of both a transmissive LCD device and a reflective LCD device. Because the transflective LCD device uses a back light as well as an exterior natural light source or an artificial light source, it is not dependent upon exterior light source conditions, and consumes relatively low power.

FIG. 1 is an exploded perspective view illustrating a typical transflective LCD device.

As shown, the typical transflective LCD device 11 includes an upper substrate 15 having a common electrode 13 formed on a black matrix 16 a sub-color filter 17, and a lower substrate 21 having a pixel electrode 19 having a transmissive region A and a reflective region C, a switching element T and an array line. A liquid crystal 23 is interposed between the upper substrate 15 and the lower substrate 21.

FIG. 2 is a cross-sectional view illustrating a typical transflective LCD device.

As shown, the schematic transflective LCD device 11 includes a upper substrate 15 having the common electrode 13, a lower substrate 21 having a pixel electrode 19 having a reflective electrode 19b having a through-hole A and a transparent electrode 19a, a liquid crystal 23 interposed between the upper substrate 15 and the lower substrate 21, and a back light 41 disposed below the lower substrate 21.

When the above transflective LCD device 11 is operated in a reflective mode, an exterior natural light source or an exterior artificial light source is used.

With reference to the above-explained structure, operations of the transflective LCD device for the reflective and transmissive modes will be explained

For the reflective mode, the transflective LCD device uses an exterior natural light source or an exterior artificial light source. The incident light "B" passes through the upper substrate 15 and is reflected by the reflective electrode 19b back through the liquid crystal 23, which is aligned by the application of an electric field between the reflective electrode and the common electrode 13. Accordingly, the aligned liquid crystal 23 controls the incident light "B" so as to display an image.

To the contrary, for the transmissive mode, the transflective LCD device uses a light "F", which radiates from the back light 41. The light "F" passes through the transparent electrode 19a to the liquid crystal 23, which is aligned by the application of an electric field between the transparent electrode 19a and the common electrode 13 below the through-hole. Accordingly, the aligned liquid crystal layer 23 controls the light "F" so as to display an image.

FIG. 3 is an expanded plan view illustrating a portion of an array substrate as a lower substrate.

A lower substrate 22 is referred to as an array substrate, and thin film transistors T as switching elements are arranged in a matrix type. The thin film transistor T is disposed where a gate line 25 and a data line 27 cross each other.

At this time, the gate line 25 and the data line 27 crossing each other define a pixel region P.

A storage capacitor S is disposed on a portion of the gate line 25, and is electrically connected in parallel to a pixel electrode disposed in the pixel region.

A gate pad 29 and a data pad 31 are disposed at one ends of the gate line 25 and data line 27, respectively.

The thin film transistor T includes a gate electrode 32, a source electrode 33, a drain electrode 35 and an active layer 34 on the gate electrode.

At this time, the transmissive pixel electrode 19 includes a transparent electrode and a reflective electrode having a through-hole, and is divided into a transmissive portion A and a reflective portion B.

In such structure, for the transflective LCD device, processes for patterning an opaque metal in the reflective portion and a transparent metal in the transmissive portion are necessary, and during the such processes, corrosion of the metal electrodes occurs due to galvanic phenomenon between the reflective electrode and the transparent by an etching solution.

Hereinafter, with reference to FIGs. 4a to 4d, a structure and a fabricating method of FIG. 3 according to the conventional method is simply explained.

FIGs. 4a to 4d are sequential processing cross-sectional views taken along lines II-II`, III-III` and IV-IV` of FIG. 3.

At first, as shown in FIG. 4a, a gate electrode 32, a gate line 25 and a gate pad 29 of a predetermined area at one end of the gate line are formed on a substrate 21, and then a gate-insulating layer 43 is formed on the substrate having the gate line et al..

Next, on the gate-insulating layer 43 over the gate electrode 32, an active layer 45 of amorphous silicon (a-Si) and an ohmic contact layer 47 of impurity-doped amorphous silicon (n+a-Si:H) which are stacked in island-shape are formed.

Next, a source electrode 33 and a drain electrode 35 on the ohmic contact layer 47, a data line (27 in FIG. 3) extended perpendicularly to the source electrode 33 and a data pad 42 of a predetermined area at one end of the data line are formed.

At the same time, a source-drain metal layer 49 having island-shape is formed on a portion of the gate line 25 defining the pixel region (P in FIG. 3).

Next, as shown in FIG. 4b, an insulating material is deposited on the substrate 21 having the data line (27 in FIG. 3) et al. to form a first passivation layer 51.

Next, the first passivation layer 51 is patterned to form a first drain contact hole 53 over the drain electrode 35, and a portion of the first passivation layer defined as a transmissive portion of the pixel region is etched to form an etching hole 55.

At the same time, a first storage contact hole over the source-drain metal layer 49 is formed, a first gate pad contact hole 59 over the gate pad 29 and a first data pad contact hole 61 over the data pad 42 are formed.

Next, a transparent conductive metal such as indium-tin-oxide (ITO) and indium-zinc-oxide (IZO) is deposited on the first passivation layer 51 having the contact holes and patterned to form a pixel electrode 63. One side of the pixel electrode contacts the drain electrode 35, and the pixel electrode passes through the pixel region (P in FIG. 3), is extended toward a portion over the gate line 25, and contacts the source-drain metal layer 49 through the first storage contact hole 57.

The source-drain metal layer 49 contacting the pixel electrode 63 acts as a second storage electrode, and the source-drain metal layer and the gate line 25 as a first storage electrode constitute a storage capacitor (S in FIG. 3).

At the same time, a gate pad terminal electrode 65 connected to the gate pad 29 through the first gate pad contact hole 59 and a data pad terminal 67 connected to the data pad 42 through the first data pad contact hole 61 are formed.

As shown in FIG. 4c, an insulating material is deposited entirely on the substrate 21 having the patterned transparent electrode to form a second passivation layer 69. The second

passivation layer 69 is patterned to form a second drain contact hole 53` exposing the transparent electrode 63 contacting the drain electrode 35, and a portion of the second passivation 69 over the first storage contact hole (57 in FIG. 4b) is patterned to form a second storage contact hole 57`.

An opaque conductive metal having good resistance and reflectance such as aluminum (Al) or aluminum alloy (AlNd) is deposited on the second passivation layer 69 on the contact holes and patterned to form a reflective electrode 71. The reflective electrode 71 has a through-hole at a position corresponding to the etching hole 55. One side of the reflective electrode 71 contacts the transparent electrode 63 through the second drain contact hole 53`, and other side of that is connected to the transparent pixel electrode contacting the source-drain metal layer 49 through the second storage contact hole 53`.

Next, as shown in FIG. 4d, the exposed second passivation layer 69 is patterned to form a second gate pad contact hole 59` and a second data pad contact hole 61` over the gate pad terminal electrode 65 and the data pad terminal electrode 67, respectively.

Through the above method, an array substrate for the conventional transflective LCD can be fabricated.

In the above processes, the reason for etching the first passivation layer 51 corresponding to the transmissive portion (A in FIG.3) of the pixel region (P in FIG. 3) and the gate-insulating layer 43 therebelow is to match light-passing distances through the transmissive portion (A in FIG. 3) and the reflective portion B, and to get the uniform color purity of the light according to each mode.

Furthermore, the reason for disposing the second passivation 69 between the transparent pixel electrode 63 and the reflective electrode 61 is to prevent the electrode

corrosion caused by transition phenomenon between the transparent pixel electrode 63 and the reflective electrode 71 due to the etching solution for the reflective electrode 71.

The corrosion phenomenon is referred to as galvanic corrosion. As explained more particularly, when different kind of metals are dipped in a solution, voltage difference is caused, and thus the phenomenon that an electron moves therebetween occurs.

According to this phenomenon, the contacted metals are corrosive, and thus contacting resistance between the two electrodes is affected adversely.

Therefore, as explained above, the second passivation layer 69 further is formed between the above two electrodes.

However, when the passivation is disposed between the two electrodes, as explained above, a mask process to pattern the passivation layer and a mask process to expose the gate pad terminal electrode 65 and the data pad terminal electrode 67 after patterning the reflective electrode 71 further are added.

As explained more particularly, since each terminal electrode 65 and 67 over the gate pad and the data pad is formed using the transparent electrode instead of the reflective electrode, a process exposing each pad portion is added in last process to prevent reaction with the reflective electrode by an etching solution.

Furthermore, a pin-hole may occur in a surface of the passivation layer due to poor deposition of the passivation layer. Accordingly, an etching solution for the transparent electrode is penetrated through the pin-hole, and thus the gate line of aluminum material may be corroded.

Therefore, since a fabricating method of the array substrate for the transflective LCD device according to the conventional method needs multiple processes, time and cost can not

be saved, and since the gate line is affected adversely during etching of the transflective pixel electrode, production efficiency of the LCD device is reduced.

[TECHNICAL SUBJECT OF INVENTION]

Therefore, to settle the above problems, it is the objectives of the present invention to provide an array substrate for a transflective LCD device and fabrication method thereof, which prevent galvanic corrosion between a transparent electrode and a reflective electrode constituting a pixel electrode through low cost and process simplification.

[CONSTRUCTION AND OPERATION OF INVENTION]

To achieve the objectives of the present invention, an array substrate for a transflective liquid crystal display device includes preparing a substrate; forming a gate electrode and a gate line having double metal layers, the gate pad including a gate pad at an end thereof; forming a data line crossing perpendicularly the gate line to define a pixel region, the data line including a source electrode and a data pad at an end thereof; depositing an insulating material on the substrate having the data line to form a first passivation layer, thereby forming a drain contact hole exposing the drain electrode, a first gate pad contact hole exposing the gate pad and a first data pad contact hole exposing the data pad; depositing and patterning a tranparent electrode on the first passivation layer, thereby forming a pixel electrode contacting the drain electrode at one side thereof, a gate pad terminal electrode contacting the gate pad and a data pad terminal electrode contacting the data pad; forming and patterning a second passivation layer of an insulating material on the patterned transparent electrode, thereby forming a drain contact hole exposing the drain electrode, a second gate pad contact hole exposing the gate pad and a second data pad contact hole exposing the data pad; depositing a conductive metal

on the patterned second passivation layer to form a first reflective electrode layer; depositing a metal including aluminum on the first reflective electrode layer to form a second reflective electrode layer; and etching subsequently the first reflective electrode layer and the second reflective electrode layer using different etching solutions from each other, thereby forming a reflective electrode including a first reflective electrode and a second reflective electrode including a through-hole on the pixel region and at the same time exposing the data pad terminal electrode and the gate pad terminal electrode.

The transparent electrode is one selected of a transparent conductive metal group including indium-tin-oxide and indium-zinc-oxide.

Reference will now be made in detail to embodiments of the present invention, which is illustrated in the accompanying drawings.

-- Embodiment --

In the present invention, a reflective electrode of a transmissive pixel electrode has a double-layered structure of molybdenum (Mo)/aluminum (Al), and a gate electrode has a double-layered structure of titanium (Ti)/aluminum alloy (AlNd).

Hereinafter, it is explained with reference to FIGs. 5a to 5f. (A plan view of the present invention is equal to the conventional plan view and thus uses it, and the reference number of the same elements will be used adding 100 to the conventional reference number for convenience.

At first, as shown in FIG. 5a, a gate line 125, which have a double-layered structure of titanium (Ti)/aluminum (Al), are formed on the substrate 111. The gate line 125 has a gate electrode 132 and a gate pad 129 at its end portion

Since the gate electrode 132 material is important to operate the LCD device, aluminum having low resistance is mainly used to reduce RC delay. However, pure aluminum is chemically weak corrosion resistance and may result in line defects by formation of hillocks during posterior high temperature processing. Accordingly, when aluminum for a line used, the stacking structure as explained above is applied.

In the stacking structure as explained above, when a second layer is made of titanium (Ti), it is not affected by an etching solution during patterning for a metal layer (not shown) of a transparent pixel electrode thereafter.

Next, as shown in FIG. 5b, one of an inorganic insulating material and an organic insulating material is deposited or coated on the substrate 111 having the gate line 125 et al. to form a gate-insulating layer 143. The inorganic insulating material includes silicon nitride (SiN_X) and silicon oxide (SiO_2), and the organic insulating material includes benzocyclobutene (BCB) and acrylic resin.

Next, on the gate-insulating layer 143 over the gate electrode 132, an active layer 45 of amorphous silicon (a-Si:H) and an ohmic contact layer 47 of impurity-doped amorphous silicon (n+a-Si:H) which are stacked in island-shape are formed.

Next, chromium (Cr) is deposited on the ohmic contact layer 147 and patterned to form a source electrode 133 and a drain electrode 135, and a data line (not shown) extended perpendicularly to the source electrode 33. The data line has a data pad 142 at its end portion.

At this time, since an uppermost layer of the gate electrode 132 and the gate line 125 is made of titanium material, those are not affected by an etching solution (etchant) for the chromium layer.

At the same time of patterning the source electrode 133 and the drain electrode 135, a source-drain metal layer 149 having island-shape is formed on a portion of the gate line defining the pixel region (P).

Next, as shown in FIG. 5c, the above-explained insulating material is deposited on the substrate 111 having the data line 125 et al. to form a first passivation layer 151.

Next, the first passivation layer 151 is patterned to form a first drain contact hole 153 over the drain electrode 135, and a portion of the first passivation layer defined as a transmissive portion A of the pixel region is etched to form an etching hole 155.

At the same time, a storage contact hole 157 over the source-drain metal layer 149 is formed, a first gate pad contact hole 159 over the gate pad 129 and a first data pad contact hole 161 over the data pad 142 are formed.

Next, a transparent conductive metal such as indium-tin-oxide (ITO), indium-zinc-oxide (IZO) and indium-tin-zinc-oxide (ITZO) is deposited on the first passivation layer 151 having the contact holes and patterned to form a pixel electrode 163. One side of the pixel electrode contacts the drain electrode 135, and the pixel electrode passes through the pixel region (P in FIG. 3), is extended toward a portion over the gate line 125, and contacts the source-drain metal layer 149 through the first storage contact hole 157.

The source-drain metal layer 149 contacting the transparent pixel electrode 163 acts as a second storage electrode, and the source-drain metal layer and the gate line as a first storage electrode constitute a storage capacitor (S in FIG.3).

At the same time, a gate pad terminal electrode 165 connected to the gate pad 129 through the first gate pad contact hole 159 and a data pad terminal 167 having island-shape and connected to the data pad 142 through the first data pad contact hole 161 are formed.

Next, as shown in FIG. 5d, one of an inorganic insulating material group including silicon nitride (SiN_X) and silicon oxide (SiO_2) is deposited on the substrate 111 having the pixel electrode 163, the gate pad terminal electrode 165 and the data pad terminal electrode 167 to form a second passivation layer 169.

Next, the second passivation layer is patterned to form a second drain contact hole 153\` exposing the transparent electrode 163 contacting the drain electrode 135 and to form a second storage contact hole 157\` exposing a portion of the transparent pixel electrode 163 contacting the source-drain metal layer 149.

At the same time, a second gate pad contact hole 159\` and a second data pad contact hole 161\` exposing the gate pad terminal electrode 165 and the data pad terminal electrode 167 are formed.

Next, as shown in FIG. 5e, molybdenum (Mo) is deposited on the substrate 111 having the patterned second passivation layer 169 to form a first reflective electrode layer 166\`. Subsequently, aluminum (Al) or aluminum alloy (AlNd) is deposited on the first reflective electrode layer to form a second reflective electrode layer 168\`.

Next, the second reflective electrode layer 168\` of aluminum alloy is etched using a acid-mixed solution (a mixed etching solution of phosphoric acid (H_3PO_4), acetic acid (CH_3COH) and nitric acid (HNO_3)).

Through the above process, as shown in FIG. 5f, the first reflective electrode layer (166\` in FIG. 5e) and the second reflective electrode layer (168\` in FIG. 5e) become a first reflective electrode 166 and a second reflective electrode 168 which have a through-hole A at the same position.

At the same time of patterning of the first reflective electrode 166 and the second reflective electrode 168, the gate pad terminal electrode 165 and the data pad terminal electrode 167 are exposed.

Therefore, since separate process of etching the second passivation layer 169 to expose the gate pad terminal electrode and the data pad terminal electrode is omitted, it is achieved that processes are simplified

Furthermore, although a pin-hole occurs due to poor deposition of the passivation layer, defects of the gate line due to an etching solution for the transparent electrode is free.

[EFFECT OF INVENTION]

Therefore, the transflective LCD device according to the present invention has a structure that galvanic phenomenon does not occur when the reflective electrode and the transparent electrode constituting the transflective electrode are patterned, and has an effect that processes is simplified and thus costs are reduced since separate mask process exposing the gate pad and the data pad is not necessary.

Furthermore, since the gate line has a double-layered structure of an aluminum layer (first layer)/a titanium (second layer) and titanium has a strong corrosive resistance, the gate line is not affected by an etching solution for the transparent electrode, and thus inferiority of the substrate can be prevented.

[RANGE OF CLAIMS]

[CLAIM 1]

A fabricating method of an array substrate for a liquid crystal display device, comprising:

preparing a substrate;

forming a gate electrode and a gate line having double metal layers, the gate pad including a gate pad at an end thereof;

forming a data line crossing perpendicularly the gate line to define a pixel region, the data line including a source electrode and a data pad at an end thereof;

depositiong an insulating material on the substrate having the data line to form a first passivation layer, thereby forming a drain contact hole exposing the drain electrode, a first gate pad contact hole exposing the gate pad and a first data pad contact hole exposing the data pad;

depositing and patterning a tranparent electrode on the first passivation layer, thereby forming a pixel electrode contacting the drain electrode at one side thereof, a gate pad terminal electrode contacting the gate pad and a data pad terminal electrode contacting the data pad;

forming and patterning a second passivation layer of an insulating material on the patterned transparent electrode, thereby forming a drain contact hole exposing the drain electrode, a second gate pad contact hole exposing the gate pad and a second data pad contact hole exposing the data pad;

depositing a conductive metal on the patterned second passivation layer to form a first reflective electrode layer;

depositing a metal including aluminum on the first reflective electrode layer to form a second reflective electrode layer; and

etching subsequently the first reflective electrode layer and the second reflective electrode layer using different etching solutions from each other, thereby forming a reflective electrode including a first reflective electrode and a second reflective electrode including a through-hole on the pixel region and at the same time exposing the data pad terminal electrode and the gate pad terminal electrode.

[CLAIM 2]

The fabricating method according to claim 1, wherein the transparent electrode is one selected of a transparent conductive metal group including indium-tin-oxide and indium-zinc-oxide.

[CLAIM 3]

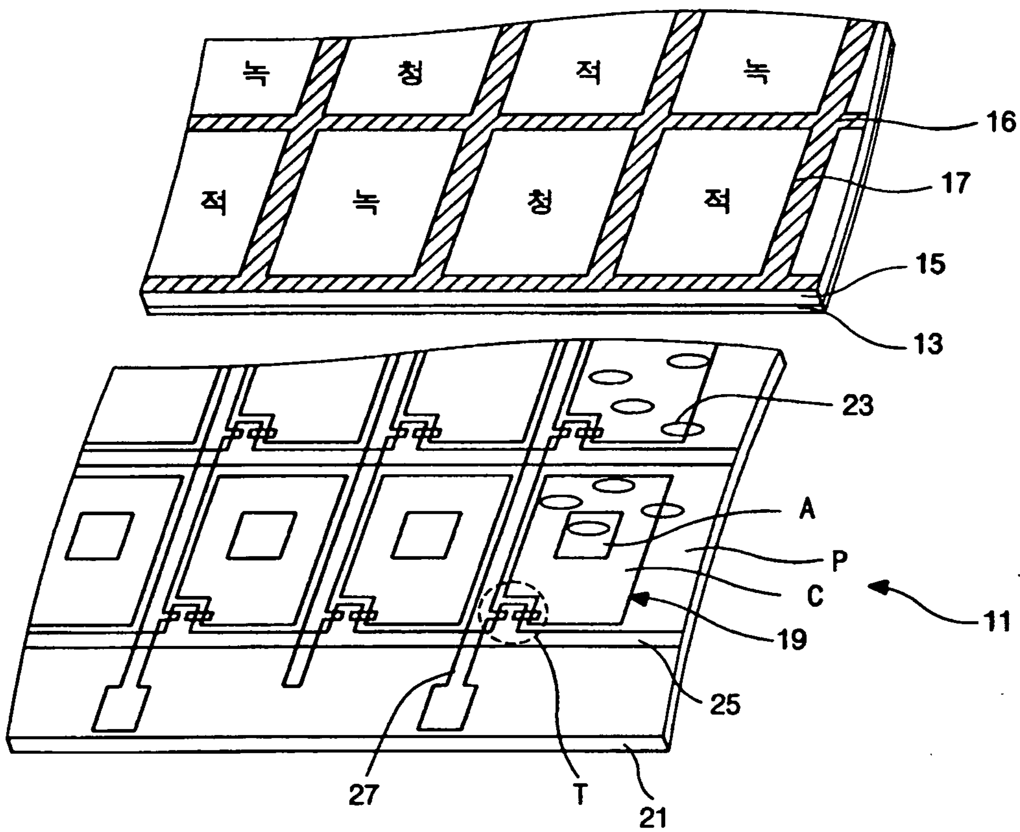
The fabricating method according to claim 1, wherein a first layer of the double metal layers is a metal including aluminum, and a second layer is titanium.

[CLAIM 4]

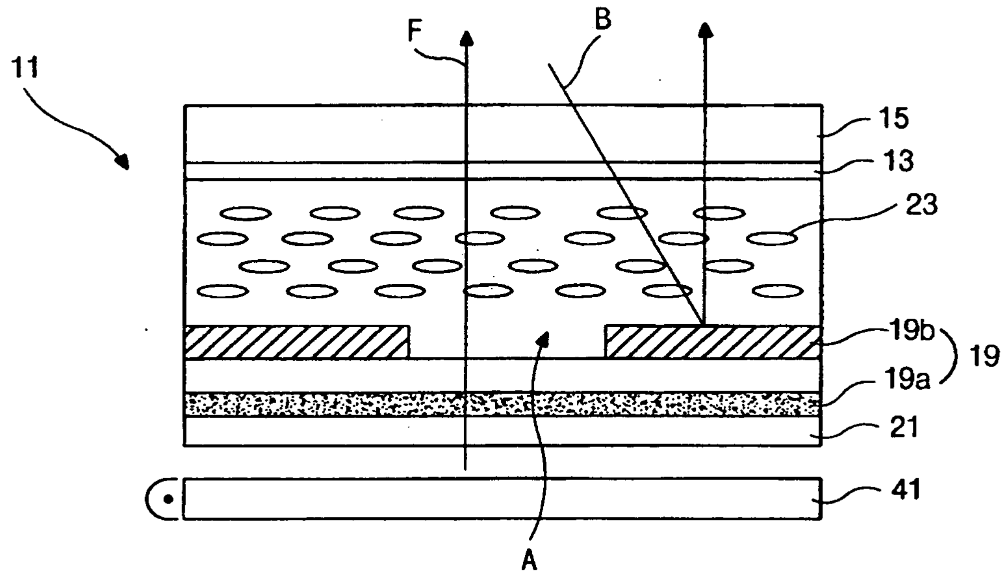
The fabricating method according to claim 1, wherein the conductive metal on the second passivation layer is molybdenum.

[DRAWINGS]

[FIG. 1]

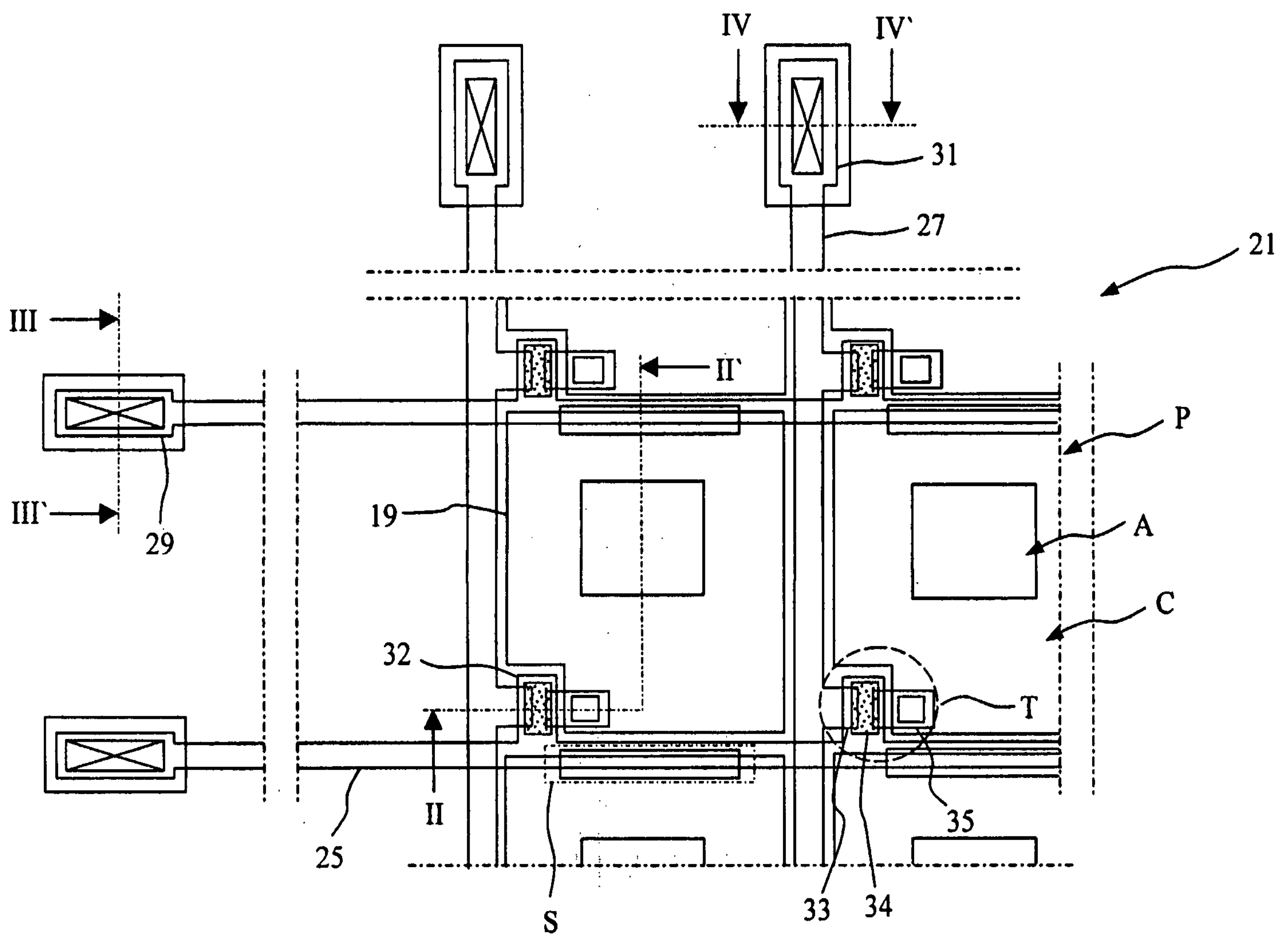


[FIG. 2]

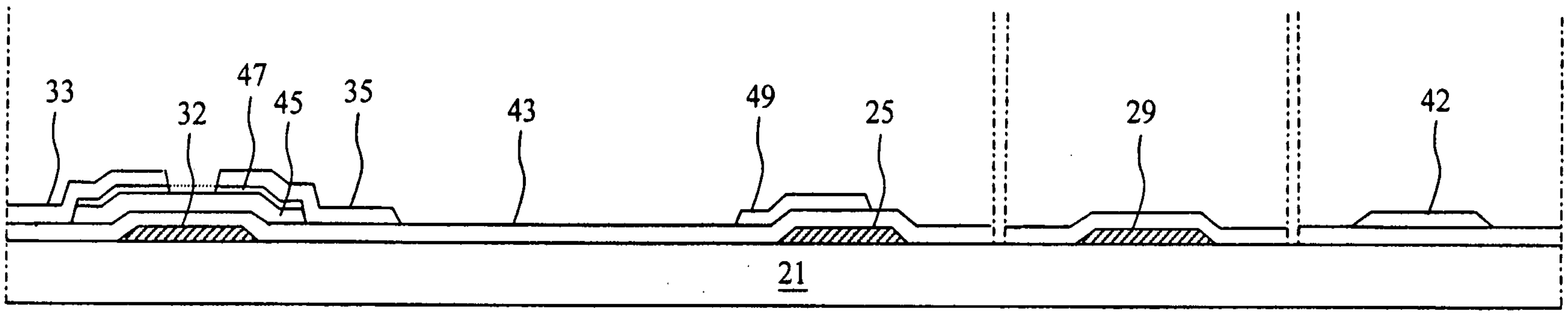


11
F
B
15
13
23
19b
19
19a
21
41
A

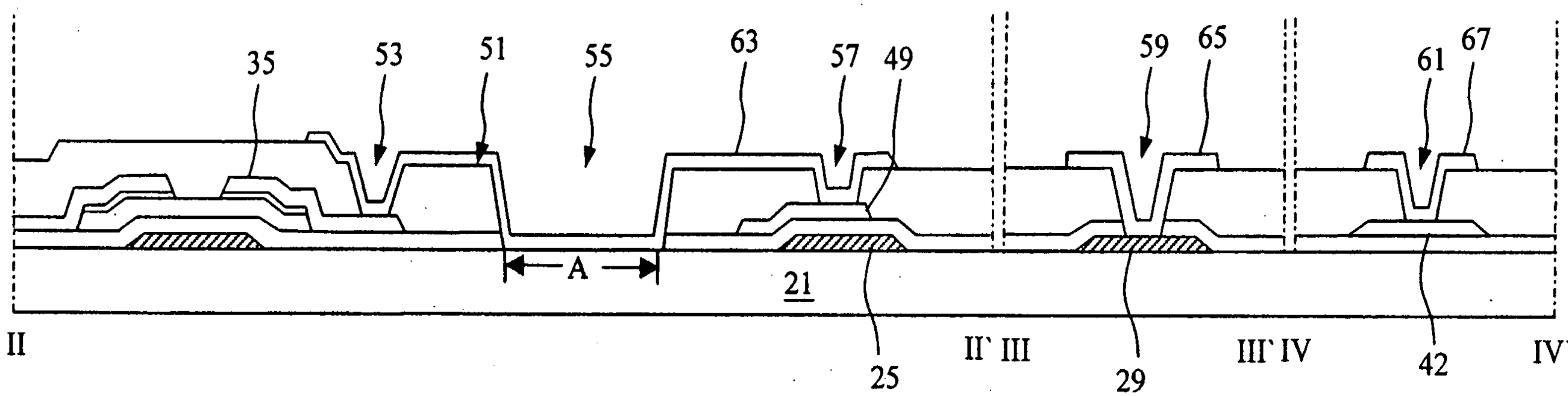
[FIG. 3]



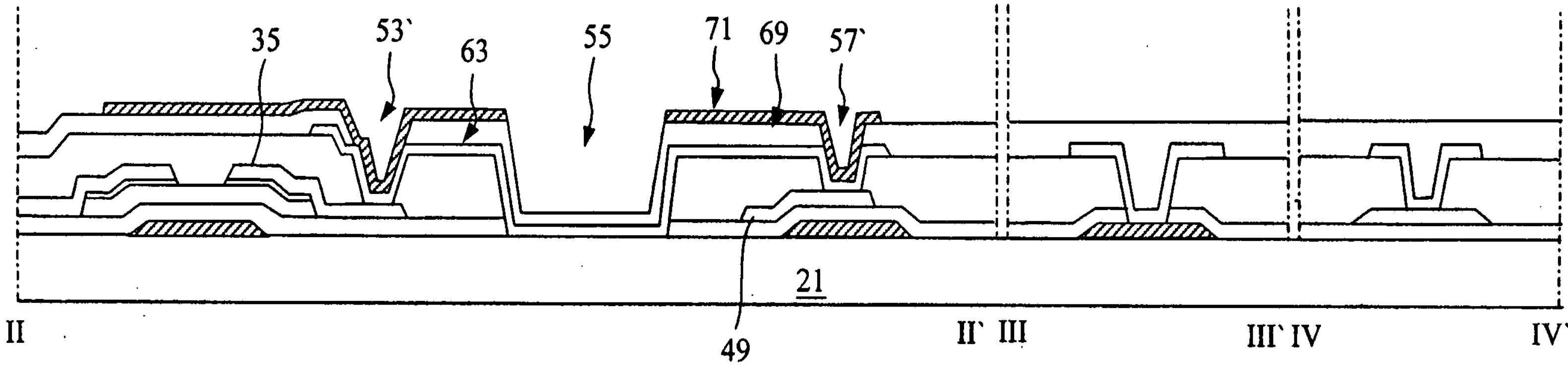
[FIG. 4a]



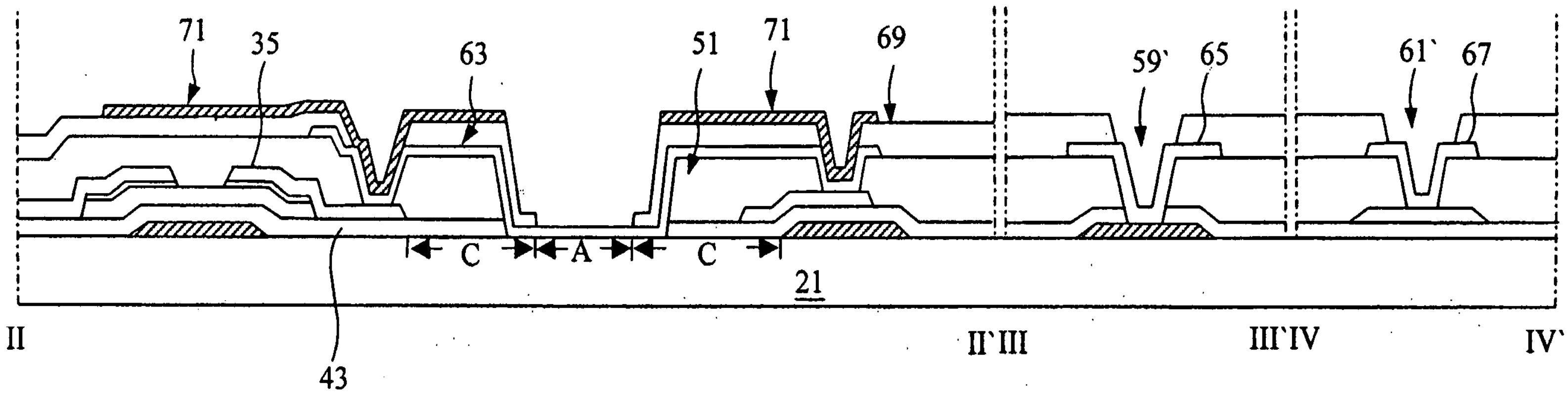
[FIG. 4b]



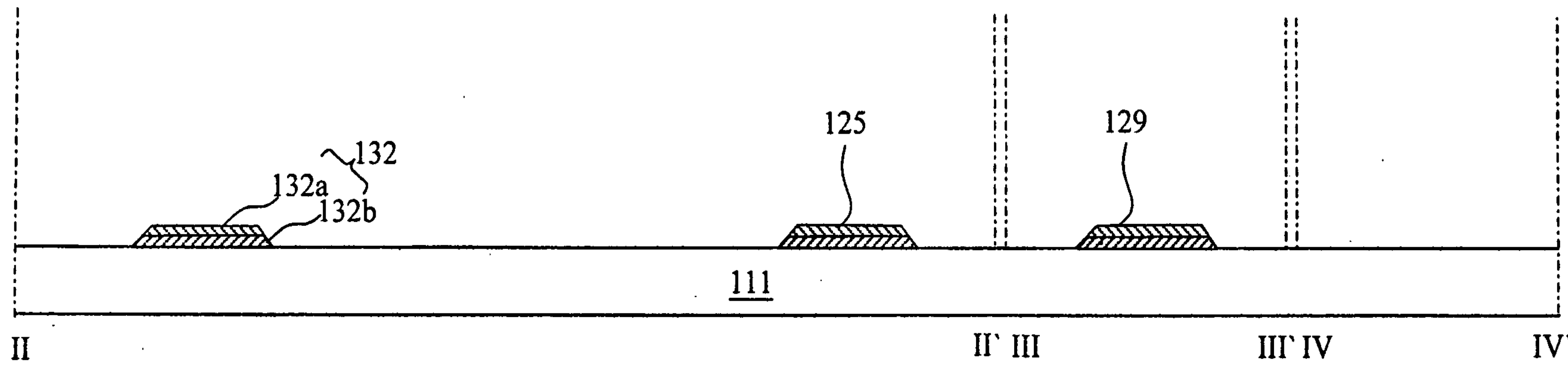
[FIG. 4c]


35
53`
63
55
71
69
57`
21
49
II
II` III
III` IV
IV`

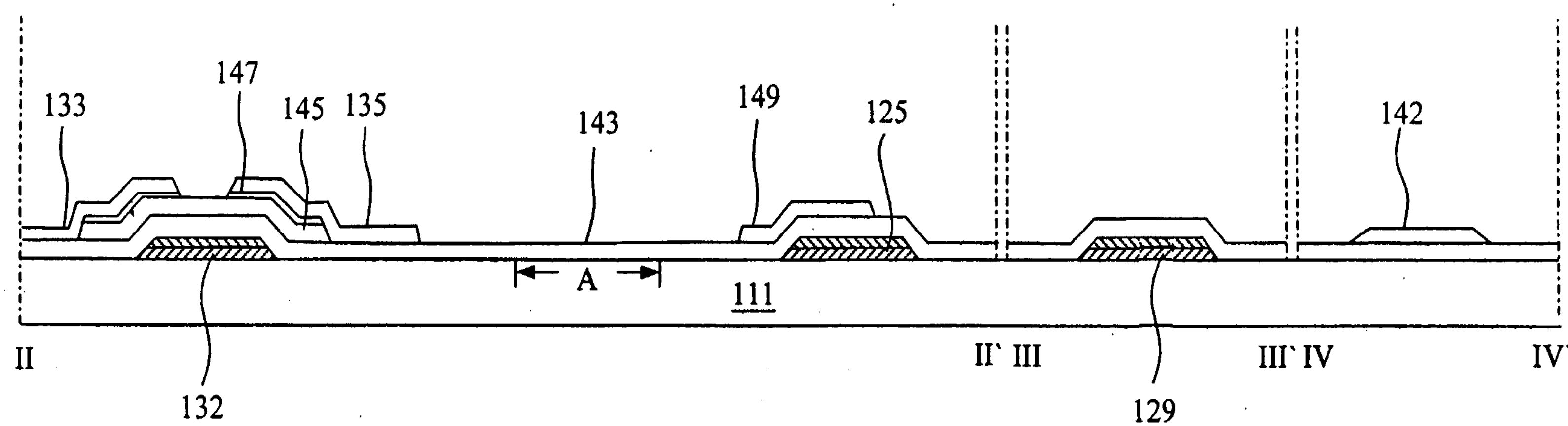
[FIG. 4d]


71
35
63
51
71
69
59`
65
61`
67
C
A
C
21
43
II
II`III
III`IV
IV`

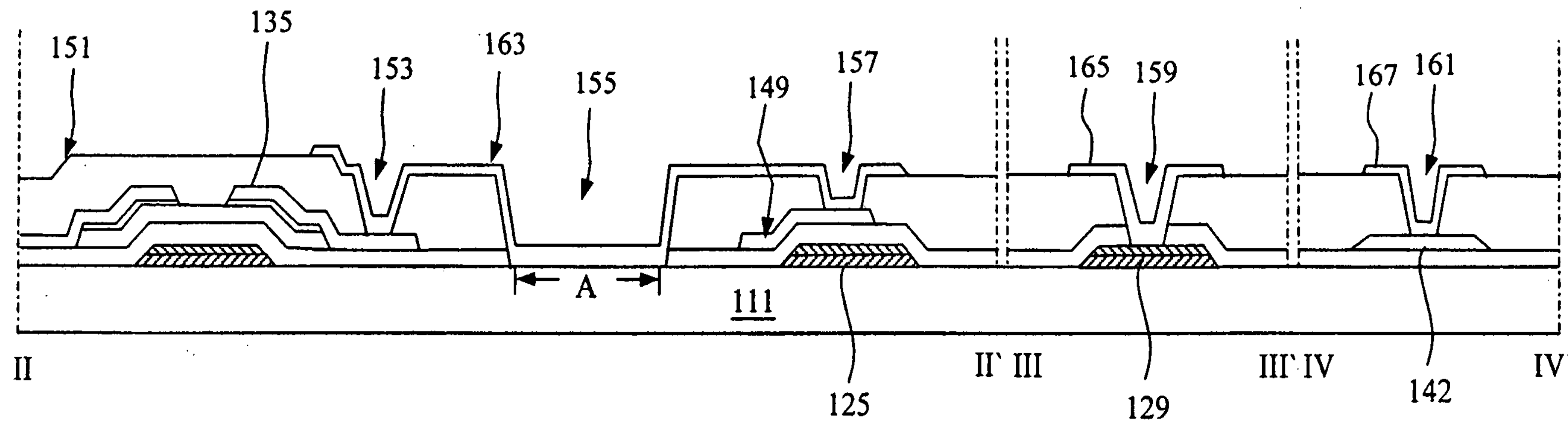
[FIG. 5a]


132
132a
132b
125
129
111
II
II` III
III` IV
IV`

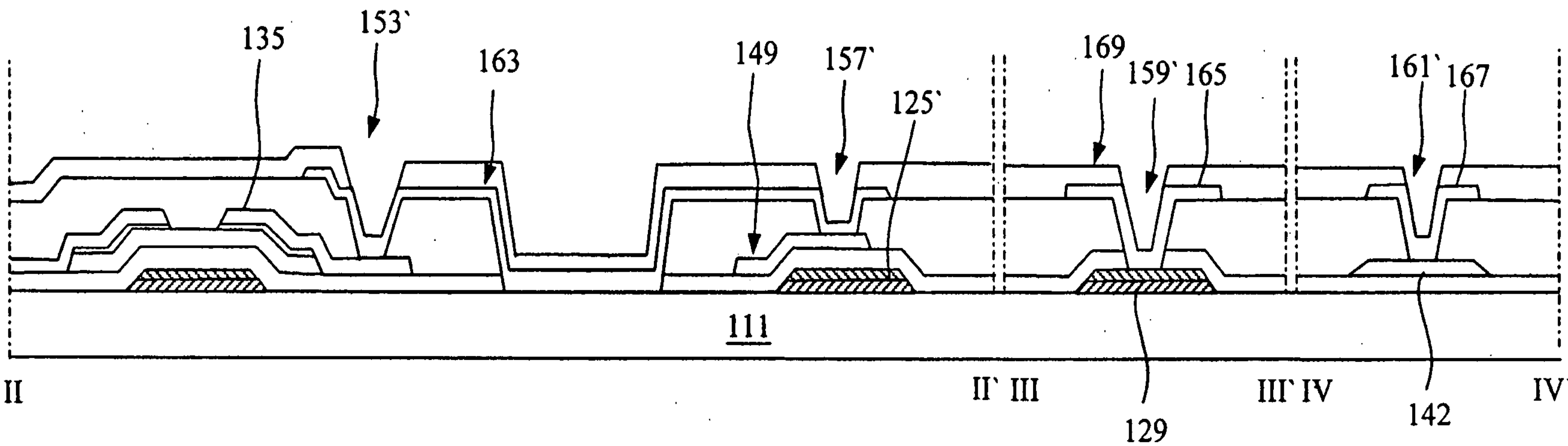
[FIG. 5b]


133
147
145
135
143
149
125
142
A
111
II
II` III
III` IV
IV`
132
129

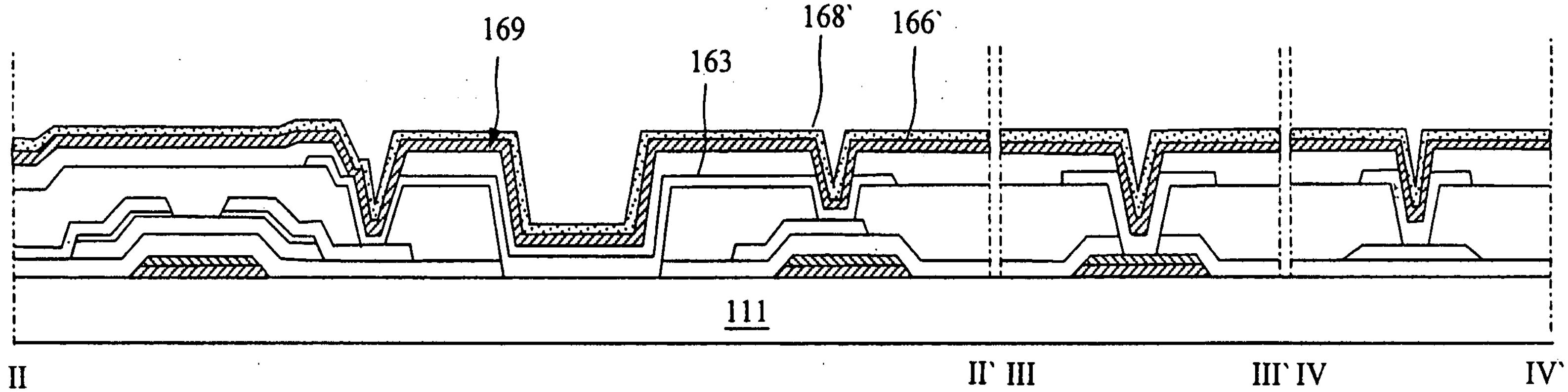
[FIG. 5c]


151
135
153
163
155
149
157
165
159
167
161
A
111
II
II` III
III` IV
IV`
125
129
142

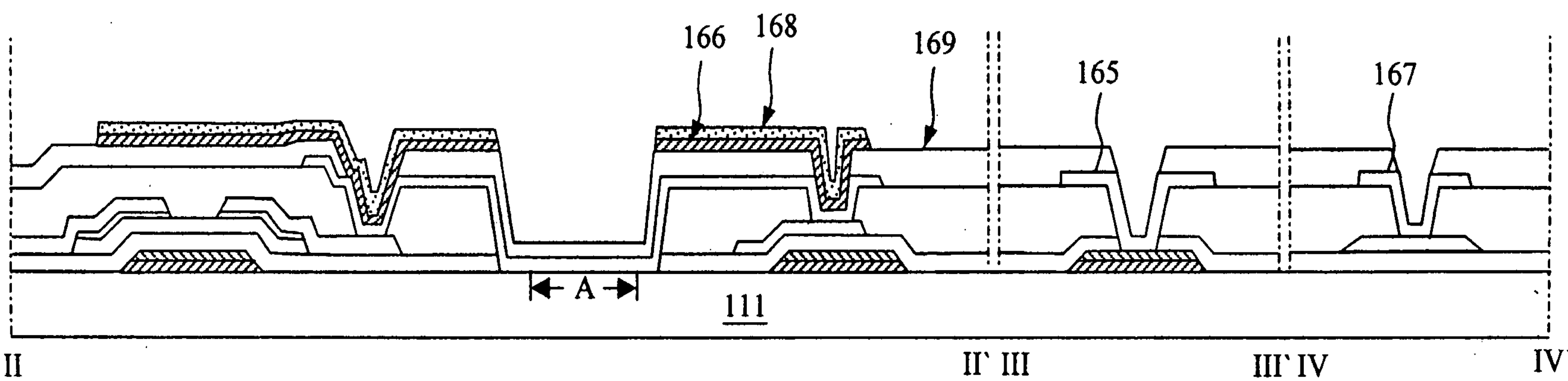
[FIG. 5d]


135
153`
163
149
157`
125`
169
159`
165
161`
167
111
II
II` III
III` IV
IV`
129
142

[FIG. 5e]


169
163
168`
166`
111
II
II` III
III` IV
IV`

[FIG. 5f]


166
168
169
165
167
A
111
II
II` III
III` IV
IV`